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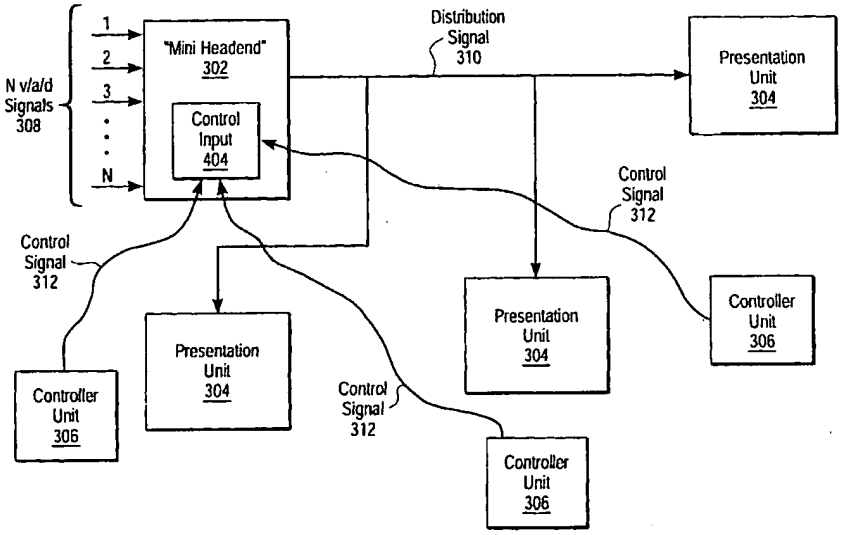
(54) Title: VIDEO/AUDIO/DATA DISTRIBUTION ARCHITECTURE



(57) Abstract: A system architecture for controlled distribution of video, and/or audio, and/or data (v/a/d) within a home or business includes a single "mini headend" (302) for receiving v/a/d (308) signals and for distributing the v/a/d (308) to presentation units (304) within the home or business. The mini headend (302) may receive v/a/d (308) from various sources. Based on control signals received from one or more control units (306), the mini headend (302) selects v/a/d (308) signals for modulation onto a plurality of carrier signals or communication channels. The modulated carrier signals are multiplexed into a distribution signal which is transmitted to the presentation units (304).

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VIDEO/AUDIO/DATA DISTRIBUTION ARCHITECTURE

BACKGROUND OF THE INVENTION

There is presently an established base of millions of conventional televisions with analog television tuners. An average American home has multiple such conventional televisions, for example, in each of various rooms, such as a family room, a living room, bedrooms, and so on.

These conventional televisions are typically designed to receive regular analog television broadcasts. They are not designed to provide conditional access to receive premium cable services. They are also not designed to receive digital television broadcasts.

In order to support conditional access and receive digital broadcasts, set-top boxes are generally required by cable and satellite television systems. Currently, various systems using advanced or sophisticated set top units are being developed and built to support the increasing number of available channels and to support additional services such as video on demand, Internet access, and so on. Such systems utilizing advanced or sophisticated set-top units are the subject of various recent U.S. patent publications.

For example, U.S. Patent No. 5,905,942, issued May 18, 1999, to Leon P. Stoel et al. (hereinafter Stoel et al.) describes an audio/video distribution system for a multiple dwelling unit such as an apartment building. The system uses a subscriber remote control 46 with an infrared transmitter to transmit controls to an infrared receiver within a subscriber terminal (set-top unit) located within a subscriber unit (apartment), and programming and services are supplied from a headend over a distribution network to individual apartments. The distribution network includes an interdiction field unit associated with each of a group of apartments. The interdiction field unit normally interdicts those channels capable of carrying video on demand movies, interactive video games, and interactive services. When a subscriber wishes to order a movie, video game, or other service through interactive on-screen menus provided from the headend to the apartment, the headend instructs the interdiction field unit associated with the subscriber's apartment to de-interdict a channel. Selections made through a remote control to a subscriber terminal in the apartment are supplied to the headend over the distribution system. The channel remains deinterdicted during the playing of a movie, video game, or

interactive service selected by the subscriber, based upon the signals received from the subscriber terminal during the interactive on-screen menu session.

As another example, U.S. Patent No. 5,914,746, issued June 22, 1999, to Joseph H. Matthews, III, et al. (hereinafter Matthews et al.), describes a subscriber interface unit (set top box) for use in conjunction with a television and a remote cable network headend having a plurality of available programs. The available programs include broadcast television channels and executable applications, the latter intended to be received and executed at the subscriber interface unit. The subscriber interface unit maintains a virtual channel table having entries for a plurality of virtual channel numbers. An entry for a particular virtual channel number includes a designation of an available program from the headend which is to be associated with the virtual channel number. The program can be a broadcast channel or an executable application such as an electronic programming guide. The subscriber interface unit has a channel selector which maintains a current virtual channel number and which is responsive to commands by a human viewer to change the current virtual channel number. When a virtual channel is selected, the subscriber interface unit requests associated program from the remote headend and presents it on the video display device. If the selected virtual channel is associated with an executable application, the subscriber interface unit downloads and executes the application.

As a further example, U.S. Patent No. 6,064,377, issued May 16, 2000, to W. Leo Hoarty and Gary M. Lauder (hereinafter Hoarty et al.) describes an interactive television information system and an interactive service distribution network, where each subscriber television is associated with a home interface controller (set top unit). The home interface controllers receive the television information signals and include a data transceiver for data communications. A subscriber selection device associated with a home interface controller permits subscriber interaction through the data transceiver with an assigned interactive controller from a plurality of interactive controllers. The assigned interactive controller is in communication with the information sources and in television communication with its assigned home interface controller. Selection of an information source may be made through channel selection of an apparent channel from any of a first group of apparent channels and a second group of apparent channels. Different information services on different apparent channels from the first group of apparent channels are provided to a given home interface controller via the same television information signal as the subscriber changes channel selection from one of the apparent

channels in the first group of apparent channels to another apparent channel in the first group of apparent channels. To receive apparent channels from the second group of apparent channels, a home interface controller simply selects the television information signal at its input corresponding to the selected channel.

Unfortunately, system architectures that utilize advanced or sophisticated set top units have substantial disadvantages and problems. For example, each television requires its own corresponding set-top unit in order to support conditional access and receive digital broadcasts. With multiple televisions in the average American home, this means that multiple set-top units are required to provide such support at every television in an average home. Furthermore, each set-top unit incorporates significant electronic components and is thus costly to produce. Such costs per set-top unit must be multiplied by the number of set-top units needed in a home. Moreover, additional power and cabling are required by each set-top unit.

SUMMARY OF THE INVENTION

The present invention provides a new system architecture for controlled distribution of video, and/or audio, and/or data (v/a/d) within a home or business. The architecture includes a single "mini headend" for receiving v/a/d signals and for distributing the v/a/d to presentation units within the home or business.

The mini headend may receive v/a/d from various sources. Based on control signals received from one or more control units, the mini headend selects v/a/d signals for modulation onto a plurality of carrier signals or communications channels. The modulated carrier signals are multiplexed into a distribution signal which is transmitted to the presentation units. Each presentation unit may be configured to demultiplex and demodulate a specific carrier signal to derive the v/a/d signals therefrom.

The system architecture enables controlled distribution of video signals received in digital form to a plurality of analog television receivers in a building. Advantageously, this is accomplished while avoiding the prohibitive cost associated with providing multiple set-top units. In addition, the centralized nature of the system architecture may provide for additional advantages and features.

BRIEF DESCRIPTION OF THE DRAWINGS

The teachings of the present invention can be readily understood by considering the following detailed description in conjunction with the accompanying drawings:

FIG. 1 depicts a conventional cable television system which includes cable headends;

FIG. 2 depicts various sources of video, audio, and/or data information to a home or business in accordance with an embodiment of the present invention;

FIG. 3 depicts a system architecture for distribution of video, audio, and/or data information within a home or business in accordance with an embodiment of the present invention;

FIG. 4 depicts a structure of a mini headend in accordance with an embodiment of the present invention;

FIG. 5 is a flow chart which depicts a process performed by a mini headend for distributing video/audio/data information in accordance with an embodiment of the present invention;

FIG. 6 is a flow chart which depicts a process performed by a presentation unit for receiving and presenting video/audio/data information in accordance with an embodiment of the present invention; and

FIG. 7 is a flow chart which depicts an end-to-end process for selecting particular video/audio/data information for presentation at a particular presentation unit in accordance with an embodiment of the present invention.

DESCRIPTION OF THE SPECIFIC EMBODIMENTS

FIG. 1 depicts a conventional cable television system which includes cable headends 11. Cable headends 11 of a conventional cable television system are described herein for purposes of contrasting them with the mini headends of the present invention.

As shown in FIG. 1, a cable headend 11 is in communication with a plurality of nodes 12 that in turn communicate with set top units 13. Each of these set top units has a remote control 14 operable by the user. Each cable headend 11 may obtain items for use in providing an information service from a regional processing center 15, which in turn may obtain some information services from a national processing center 16. The information services may include a wide range of offerings, such as classified advertising services, newspapers, advertising, televised catalogue ordering, video on

demand or near video on demand, etc. Information services that are conventional television network programming may also be distributed from the national and regional processing centers.

A conventional cable headend 11 as depicted in FIG. 1 is designed to distribute potentially hundreds of cable television broadcasts, statically assigned at the headend, to particular channels to a multitude (many thousands) of homes. In contrast, a mini headend in accordance with the present invention is designed to distribute a smaller number of broadcasts, on dynamically assigned channels as determined by end users, within a single home or business.

FIG. 2 depicts various sources 202 of video, and/or audio, and/or data (v/a/d) information to a home or business 204 in accordance with an embodiment of the present invention. The information sources 202 depicted in FIG. 2 include satellite 202-a, digital subscriber line (DSL) 202-b, cable 202-c, telephone 202-d, optical fiber 202-e, microwave or other wireless sources 202-f, and power lines 202-g.

These sources 202 provide a variety of v/a/d. Satellite sources 202-a include digital satellite television services, such as those provided by Echostar or DirectTV, and other services, such as those that provide Internet content and other data via satellite transmission. DSL sources 202-b include Asymmetric Digital Subscriber Line (ADSL) services and other various types of DSL services. Cable sources 202-c include analog and digital cable television broadcasts, pay-per-view services, video on demand services, cable modem services, and other information services utilizing a cable distribution network. Telephone sources 202-d include plain old telephone service (POTS) (including dial-up modem and fax connections) and integrated services digital network (ISDN) connections. Optical fiber sources 202-e utilize optical fiber for distribution of information and include fiber-to-the-curb (FTTC), fiber-to-the-building (FTTB), and other distribution systems. Other technologies utilize microwave and other wireless sources 202-f or power lines 202-g as ways to distribute information to a home or building 204.

FIG. 3 depicts a system architecture 300 for distribution of v/a/d information within a home or business in accordance with an embodiment of the present invention. The system 300 includes a mini headend 302, a plurality of presentation units 304, and one or more controller units 306. The mini headend 302 receives a plurality of N v/a/d signals 308. These N v/a/d signals 308 may arrive from any of the various sources 202 depicted in FIG. 2.

The mini headend 302 outputs a distribution signal 310 to the plurality of presentation units 304. The distribution signal 310 may be transmitted to the presentation units 304, for example, as a radio frequency (RF) signal via a coaxial cable distribution system within the home or business. Many homes already have coaxial cable in place to distribute analog cable television signals to various rooms in the home. The RF signal may carry signals in accordance with the National Television Systems Committee (NTSC) standard prevalent in North America, or the PAL or SECAM standards prevalent in Europe, or other standards or proprietary schemes.

In accordance with an embodiment of the present invention, the coaxial cable distribution system may be used to provide DC power, in addition to transmitting the distribution signal 310. Various devices connected to the coaxial cable distribution system may require DC power. Conventionally, such a device includes a power supply with an attached power cord and plug, which consume an additional AC plug outlet in the home or business. Such a device typically also require an enclosure which may inconveniently occupy additional space, such as space on top of a TV set. By using the coaxial cable distribution system to provide DC power, cost and inconvenience associated with providing DC power can be dramatically decreased.

As an illustrative example, the center conductor of the coaxial cable can be used to provide DC power. In this example, each device connected to the coaxial cable distribution system may operate without a power supply of its own. The arrangement saves cost and reduces consumption of AC power plug outlets in the home or business. In addition, the size of such a device can thus be reduced, such that the device can fit in line with the coaxial cable as a dongle rather than a box placed, for example, on the TV set. It is a straightforward manner to prevent the DC levels and RF signals from interfering with each other through the use of suitable components such as capacitors and inductors.

Alternatively or additionally, the distribution signal 310 may be transmitted to the presentation units 304 as a remodulated signal via other transmission technologies, such as optical fiber, wireless, telephone lines, or power lines. The remodulated signal may be of digital form and may comprise, for example, a quadrature amplitude modulated (QAM) signal. The remodulated signal may be used to distribute data information in accordance with DOCSIS (Data Over Cable Service Interface Specification), or DAVIC (Digital Audio-Visual Council) or IEEE standards, or other

standards or proprietary schemes. Providing DC power through the distribution system may also be achieved using these other transmission techniques.

Alternatively or additionally, the distribution signal 310 may include a/v/d signal(s) that are received by the mini headend 302 and passed through, without remodulation, by the mini headend 302. These signals may be received by the mini headend 302 in either digital or analog form, and they may be outputted by the mini headend 302 in either digital or analog form. The mini headend 302 may convert some, all, or none of these signals from digital to analog, or vice versa, before passing them through. In an illustrative example, the mini-headend 302 may receive four signals, two analog and two digital. The mini head end 302 may pass the two analog signals through as analog signals, pass one of the digital signals through as a digital signal, and convert the other digital signal into analog before passing it through.

The digital signals passed through by the mini head end 302 may comprise a quadrature amplitude modulated (QAM) signal. As a further example, these digital signals may be used to distribute data information in accordance with DOCSIS (Data Over Cable Service Interface Specification), or DAVIC (Digital Audio-Visual Council) or IEEE standards, or other standards or proprietary schemes.

The internal components of and processes within the mini headend 302 are described in further detail below in relation to FIG. 4. As illustrated in FIG. 3, the mini headend 302 includes a control input 404 for receiving control signals 312 from the one or more controller units 306.

The plurality of presentation units 304 receives the distribution signal 310 from the mini headend 302. The presentation units 304 may include conventional televisions or other devices which utilize television tuners (video cassette recorders, computers with television receivers, and so on) to receive and display v/a/d signals distributed from the mini headend 302. In accordance with a specific embodiment of the present invention, presentation units 304 which so utilize television receivers may receive the distribution signal 310 by way of coaxial cable from the mini headend 302.

Alternatively or additionally, the presentation units 304 may include audio equipment (for example, stereo or surround sound equipment) to receive, process, and output audio signals distributed from the mini headend 302. Alternatively or additionally, the presentation units 304 may include data presentation units, such as a personal computer with a web browser, an Internet appliance, or other devices which may utilize or present data distributed from the mini headend 302. In accordance with specific

embodiments of the present invention, the audio and/or data presentation units may receive the distribution signal 310 by way of a wireless form of communication from the mini headend 302. In accordance with other embodiments, the data presentation units may utilize cable modems for two-way communications with the mini headend 302. The cable modems may, for example, operate in accordance with the DOCSIS, or DAVIC or IEEE standards, or other standards or proprietary schemes.

The one or more controller units 306 may be utilized by end users to control the content or information presented by the presentation units 304. The controller units 306 may comprise wireless control transmitters, and the control input 404 may comprise a wireless control receiver. Preferably, such wireless devices do not require a clear line of sight to communicate with each other. For example, the wireless devices may comprise 900 MHz, 2.4 GHz, 5 GHz, or other frequency band devices. Advantageously, such non-line-of-sight wireless devices may communicate from various rooms of a home or business to a single mini headend 302 located within or nearby the home or business 204.

Alternatively or additionally, the one or more controller units 306 may communicate to the mini headend 302 via wired technologies. Examples of wired technologies include cable lines, telephone lines, or power lines. The wireless and wired technologies may be combined. For example, a controller unit 306 may communicate via wireless technology (either line-of-sight or not) with an intermediate unit, and the intermediate unit may in turn communicate via wired technology with the mini headend 302.

A controller unit 306 in accordance with an embodiment of the present invention may be substantially different from remote controls used to control set top boxes. A remote control for a set top box communicates control signals to the set top box associated with a television, typically via an infrared (direct line-of-sight) transmitter and receiver. Generally, each set top box has its own remote control. In contrast, a controller unit 306 communicates control signals to the mini headend 302 which in turn distributes information to a plurality of presentation units 304. Because a controller unit 306 communicates with the mini headend 302, instead of with a set top box, a "master" controller unit 306 may be used to control the information distributed to and presented at the plurality of presentation units 304. Alternatively or additionally, a controller unit 306 may control the information distributed to and presented at a particular presentation unit 304.

FIG. 4 depicts a structure of a mini headend 302 in accordance with an embodiment of the present invention. The mini headend 302 may be located within or nearby a home or business, e.g., 204 shown in FIG. 2. As shown in FIG. 4, the mini headend 302 may include a signal input 402, a control input 404 (shown in FIG. 3), a plurality of n selectors 406, a plurality of n modulators 408, a multiplexer 410, and an amplifier 412.

As used in this description, both N and n are positive integers. The number N corresponds to the number of v/a/d source signals 308 supported by the mini headend 302, while the number n corresponds to the number of modulated carrier signals 420 supported by the mini headend 302. In one example, the mini headend 302 may be designed for use in a residence and may include a number of modulators 408 ranging from two to ten or more. In one specific embodiment, the number of modulators 408 may be six. In another example, the mini headend 302 may be designed for use in a business and may include a large number of modulators 408 (e.g., ten, twenty, thirty, fifty, one hundred, or more).

The signal input 402 is capable of receiving a plurality of N video and/or audio and/or data (v/a/d) signals 308. Various contemplated sources for the up to N v/a/d signals 308 are described above in relation to FIG. 2. The signal input 402 outputs the up to N v/a/d signals 412 to the plurality of n selectors 406.

The control input 404 is capable of receiving control signals 312 from the controller units 306. Based on the control signals 312, the control input 404 generates selection signals 414 and outputs the selection signals 414 to the plurality of n selectors 406. It should be recognized that in general, any given one of the N v/a/d signals 412 could be directed to as many as n of the n v/a/d signals 416.

The plurality of n selectors 406 receives the up to N v/a/d signals 412 from the signal input 402 and also receives the selection signals 414 from the control input 404. Depending on the selection signals 414, the n selectors 406 select from the N v/a/d signals 412 up to n v/a/d signals 416 for output to the n modulators 408.

The plurality of n modulators 408 receives the up to n v/a/d signals 416 from the n selectors 406 and also receives up to n carrier signals 418. The up to n carrier signals 418 may be received, for example, from a signal generator within the mini headend 302. In accordance with an embodiment of the present invention, at least some of the carrier signals 418 may correspond to television channels, such as VHF channels, UHF channels, or cable television (CATV) channels.

Each modulator 408 modulates a carrier signal 418 with a v/a/d signal 416 to generate a modulated carrier signal 420. The carrier signals 420 may be of various frequencies. The modulated carrier signals 420 carries the information of the v/a/d signal 416 on the carrier signal 418. Up to n modulated carrier signals 420 are output from the plurality of n modulators 408 to the multiplexer 410. Alternatively or additionally, a single a/v/d 416 signal may be separated into multiple component signals, each component signal modulating a carrier signal 418 to produce a modulated carrier signal 420. In this manner, a single a/v/d/ signal 416 may correspond to multiple modulated carrier signals 420. This arrangement provides an efficient technique for transmitting higher quality a/v/d signals that may not be suitably represented by a single modulated carrier signal 420, due to bandwidth limitations that may exist. In one illustrative example, a video signal may be separated into a luminance (Y) component signal and a chrominance (C) component signal. The Y and C component signals each modulates a carrier signal 408, producing two modulated carrier signals 420. In another illustrative example, an audio signal may be separated into multiple component signals representing different frequency bands. Each component signal modulates a carrier signal 408, producing multiple modulated carrier signals 420.

The n modulators 408 may be implemented in a variety of ways. In one illustrative example, the n modulators 408 are implemented using P semiconductor devices, each semiconductor device containing Q modulators. Operated together, the P semiconductor devices form $n = P \times Q$ modulators. In this example, each semiconductor device modulates Q carrier signals and outputs Q modulated carrier signals as a frequency block. Using block upconverters, the frequency blocks produced by the P semiconductor devices can be upconverted such that they are consecutively arranged in the frequency spectrum, producing the n modulated carrier signals 420 that are output to the multiplexer 410. In this manner, the number n of modulated carrier signals 420 may be increased by simply adding more semiconductor devices (increasing P).

In accordance with an embodiment of the present invention, at least some of the modulated carrier signals 420 may comprise television channel signals which are modulated to carry selected video and/or audio information. The modulation may be performed, for example, in accordance to the National Television Systems Committee (NTSC) standard prevalent in North America, or the PAL or SECAM standards prevalent in Europe, or other standards or proprietary schemes.

In accordance with another embodiment of the present invention, at least some of the modulated carrier signals 420 may comprise signals which are digitally modulated to carry data information. The modulation may be performed, for example, in accordance with the DOCSIS, or DAVIC or IEEE standards, or other standards or proprietary schemes.

The multiplexer 410 receives the up to n modulated carrier signals 420 from the n modulators 408. The multiplexer 410 combines the up to n modulated carrier signals 420 to form at least one (pre-amp) distribution signal 422.

In accordance with another embodiment of the present invention, the distribution signal may also include a baseband signal. The baseband signal can be seen as one of the n modulated carrier signals 420, produced by modulating a carrier signal 418 of frequency at or near 0 Hz. Alternatively, the baseband signal may be seen as an unmodulated signal combined with the n modulated carrier signals 420 at the multiplexer 410. As an illustrative example, the baseband signal may be a video signal of improved video quality occupying the frequency band 0 to 6 MHz.

Alternatively or additionally, the distribution signal 310 may include a/v/d signal(s) that are received by the mini headend 302 and passed through, without remodulation, by the mini headend 302.

The amplifier 412 amplifies the strength of the at least one pre-amp distribution signal 422 as necessary to distribute the signal(s) to the plurality of presentation units 304 throughout the home or business 204. As depicted in FIG. 3, the (amplified) distribution signal(s) 310 is (are) output from the amplifier 412 and distributed to the plurality of presentation units 304. Certain embodiments of the present invention may not require amplification of the signal output by the multiplexer 410. For such embodiments, the amplifier 412 would not be necessary.

FIG. 5 is a flow chart which depicts a process 500 performed by the mini headend 302 for distributing video/audio/data information in accordance with an embodiment of the present invention. As depicted in FIG. 5, the process 500 includes six steps.

In a first step 502, the mini headend 302 receives up to N v/a/d signals 308 from one or more sources 202. Within the mini headend 302 shown in FIG. 4, the signal input 402 may perform this step 502. For example, the up to N v/a/d signals 308 may include a plurality of television broadcast signals.

In a second step 504, the mini headend 302 receives control signals 312 from one or more controller units 306. Within the mini headend 302 shown in FIG. 4, the control input 404 may perform this step 504. For example, a control signal 312 may indicate that a particular v/a/d signal 308 is to be presented via a particular presentation unit 304. More specifically, the particular v/a/d signal 308 may comprise a particular television broadcast signal, and the particular presentation unit may comprise a particular conventional television set in a room of a home.

In a third step 506, the mini headend 302 selects n v/a/d signals 416 depending on the control signals 312 received. Within the mini headend 302 shown in FIG. 4, the n selectors 406 may perform this step 506. Going further with the above example, among the n selected v/a/d signals 416 would be the particular television broadcast signal.

In a fourth step 508, the mini headend 302 modulates n carrier signals 418 with the n v/a/d signals 416 to form n modulated carrier signals 420. Within the mini headend 302 shown in FIG. 4, the n modulators 408 may perform this step 508. Going further with the above example, among the n modulated carrier signals 416 would be a specific television channel signal modulated to carry the particular television broadcast signal.

In a fifth step 510, the mini headend 302 multiplexes the n modulated carrier signals 420 to form one or more pre-amp distribution signal 422. Within the mini headend 302 shown in FIG. 4, the multiplexer 410 may perform this step 510. Going further with the above example, the pre-amp distribution signal 422 may comprise a multiple channel television signal that carries the specific television channel along with other channels.

Finally, in a sixth step 512, the mini headend 302 outputs the one or more (amplified) distribution signal 310 to the presentation units 304. Within the mini headend 302 shown in FIG. 4, an amplifier 412 may be used to perform this step 512. Going further with the above example, one of the presentation units 304 would comprise a conventional television set that tunes the specific television channel from the multiple channel television signal and displays the specific television channel for viewing by an end user.

The above description of the process 500 of FIG. 5 includes a specific example relating to the distribution of television programming. Of course, other

examples relating to the distribution of video/audio/data information are contemplated to be within the scope of the present invention.

One such example relates to the distribution of data information. For example, the up to N v/a/d signals 308 received by the mini-headend may include at least one data signal via a digital subscriber line 202-b or other source 202. Such a data signal may comprise, for example, a broadband Internet connection. This broadband Internet connection may be made available throughout a home or business via coaxial cable or other communications infrastructure from the mini-headend 302 to the presentation units 304. In this way, the present invention may, in some embodiments, decouple access technology (for example, DSL) from distribution technology (for example, coaxial cable using a cable modem).

In another example, a home or business may receive both a data signal (for example, via DSL) and a television signal (for example, via satellite) and distribute both signals via a communications infrastructure (for example, coaxial cable in the home or business). The television service may require that premium channels be handled on a TV set by TV set basis. Such a requirement may be implemented by requiring a set top box or other device at each TV set to have access to premium channels, so some TV sets might be free of set top boxes and others might still have them. Meanwhile, the data service may be distributed throughout the home or business using the same infrastructure.

FIG. 6 is a flow chart which depicts a process 600 performed by a particular presentation unit 304 for receiving and presenting video/audio/data information in accordance with an embodiment of the present invention. As depicted in FIG. 6, the process 600 includes four steps.

In a first step 602, the particular presentation unit 304 is set or pre-set (i.e., tuned) to demultiplex and demodulate a specific modulated carrier signal 420. Consider, for purposes of illustration, the following illustrative example relating to the distribution of television programming.

In this example, the particular presentation unit 304 may comprise a conventional television set in a bedroom of a home. This television may be set or pre-set to receive, for instance, channel 6. In accordance with this example, televisions in other rooms may be set or pre-set to receive other channels. For example, the television in the family room may be set or pre-set to receive channel 2, and the television in the living room may be set or pre-set to receive channel 3.

Alternatively, in this example, the particular presentation unit 304 may comprise a video management/recording device such as a personal video recorder (PVR). The video management/recording device may be set or pre-set to receive, for instance, channel 6. In accordance with this example, video management/recording devices in other rooms may be set or pre-set to receive other channels. For example, the video management/recording device in the family room may be set or pre-set to receive channel 2, and the video management/recording device in the living room may be set or pre-set to receive channel 3.

In a second step 604, the particular presentation unit 304 receives the distribution signal 310 from the mini headend 302. The distribution signal 310 comprises a multiplexed signal which combines up to n modulated carrier signals 420.

Going further with the above example, the distribution signal 310 may comprise a multiple-channel television signal which includes channels 2, 3, 4, 5, and 6. For example, channel 6 (which is destined for the bedroom TV) may be currently modulated to carry the Discovery Channel® (which may be channel 3 from the local cable system 202-c). Meanwhile, channels 2 and 3 may both be currently modulated to carry ESPN® (which may be channel 37 from the local cable system 202-c). (Someone in the bedroom is watching the Discovery Channel®, while persons in both the living and family rooms are watching ESPN®.)

In a third step 606, the particular presentation unit 304 tunes the specific modulated carrier signal 420 and demodulates the specific modulated carrier signal 420 to derive the v/a/d signal therefrom. Going further with the above example, the television in the bedroom would tune channel 6 from the multiple channel television signal and demodulate channel 6 to derive the Discovery Channel® broadcast therefrom.

In a fourth step 608, the presentation unit 304 presents information from the v/a/d signal to an end user. Going further with the above example, the television in the bedroom is tuned to channel 6 and would display video and audio of the Discovery Channel® broadcast to a person in the bedroom.

The above description of the process 600 of FIG. 6 includes a specific illustrative example relating to the distribution of television programming. Of course, other examples relating to the distribution of video/audio/data information are contemplated to be within the scope of the present invention.

FIG. 7 is a flow chart which depicts an end-to-end process 700 for selecting particular video/audio/data information for presentation at a particular presentation unit 304 in accordance with an embodiment of the present invention. As depicted in FIG. 7, the process 700 includes eight steps.

In a first step 702, an end user desires to receive particular v/a/d content or information via a particular presentation unit 304. For example, a person may desire to receive the Discovery Channel® via a television in a bedroom.

In a second step 704, the user selects the particular v/a/d content or information using a controller unit 306 configured for the particular presentation unit 304. Going further with the above example, the user would indicate using the controller unit 306 that the television in the bedroom should display the Discovery Channel® (which may be channel 3 from the local cable system 202-c), the controller unit 306 may be configured to control channel 6 output by the mini headend 302, and the television in the bedroom may be tuned to receive and display channel 6.

In a third step 706, appropriate control signals 312 are transmitted from the controller unit 306 to the mini headend 302. Going further with the above example, the controller signals 312 may indicate to the mini headend 302 to select the Discovery Channel® broadcast signal to be carried on channel 6 in its multichannel distribution signal 306.

In a fourth step 708, the mini headend 302 modulates a specific carrier signal with the particular v/a/d content or information. Going further with the above example, the mini headend 302 may modulate channel 6 so that it carries the Discovery Channel® broadcast signal.

In a fifth step 710, the mini headend 302 multiplexes the specific carrier signal into the distribution signal 310. Going further with the above example, the mini headend 302 may multiplex the modulated channel 6 into a multiple-channel television signal.

In a sixth step 712, the distribution signal(s) 310 is (are) transmitted from the mini headend 302 to the presentation units 304. Going further with the above example, the multiple channel signal may be distributed to televisions in various rooms.

In a seventh step 714, the particular presentation unit 304 extracts the particular v/a/d content or information from the specific carrier signal in the distribution signal 310 by tuning to its assigned channel. Going further with the above example, the

television in the bedroom may tune channel 6 from the multiple channel signal and demodulate the Discovery Channel® broadcast from the channel 6 signal.

In an eighth step 716, the particular presentation unit 304 presents the particular v/a/d content or information to the end user. Going further with the above example, the television in the bedroom may present the Discovery Channel® broadcast to the person in the bedroom.

Finally, the process 700 may loop back to the first step 702 if the end user wishes to change the v/a/d content or information presented via the particular presentation unit 304. Going further with the above example, the person may decide to switch to the ESPN® broadcast. The process 700 would then be repeated as described above with the ESPN® broadcast signal from channel 37 of the local cable system 202-c in substitution for the Discovery Channel® broadcast signal from channel 3 from the local cable system 202-c. In the repeat process 700, the television in the bedroom would typically remain configured to receive channel 6.

In addition to the above described advantages and features, the centralized nature of the system architecture may provide for additional advantages and features. Several such additional advantages and features are described below.

First, the mini headend 302 may include a centralized mechanism for implementing conditional access for distribution of premium content. Such centralized conditional access may span various sources 202 (for example, both satellite TV and cable TV).

Second, the mini headend 302 may bar certain TV receivers from displaying inappropriately rated content. For example, the mini headend 302 may detect violent or sexual content in TV programming and/or Internet data and may prevent such content from being displayed at particular presentation units.

Third, the mini headend 302 may provide a common electronic programming guide that spans various sources 202 (for example, both satellite TV and cable TV).

Fourth, the mini headend 302 may include mass storage to allow centralized digital recording. In addition, it may include an MPEG or similar encoder to allow for centralized compression and storage of analog input in digital form. Further, pay per view channels and/or a service provider specific channels may be provided directly from the digital storage at the mini headend 302.

Fifth, a DVD drive or multi-disc DVD changer may be provided at the mini-headend 302. The DVD drive may provide for centralized broadcast of DVD content. The multi-disc DVD changer may provide for centralized archiving of DVDs. Similarly, a CD drive or multi-disc CD changer may be provided at the mini-headend 302. The CD drive may provide for centralized broadcast of digital audio content. The multi-disc CD changer may provide for centralized archiving of digital audio content.

Sixth, the mini headend 302 may include circuitry capable of displaying multiple reduced-size video displays on any receiving television. Similarly, circuitry may be included to provide picture-in-picture capability at any receiving television.

Seventh, the mini headend 302 may include circuitry capable of supporting multiple game controllers to play games across multiple televisions. For example, a game player may be coupled via an interface to the mini headend 302. Circuitry within the mini headend 302 may then enable the single game player to be shared by any receiving television. The game controllers (or adapters coupled to the game controllers) would then interact with the mini headend 302 via wireless communication signals.

Eighth, the mini headend 302 may provide for residence-specific or business-specific advertisement insertion. Such specifically targeted advertisements may be transmitted from a service provider to the mini headend 302. In addition, the mini headend 302 may collect information on which channels are viewed at which TVs for purposes of determining viewing habits so as to provide more effective targeting of the advertisements.

While specific embodiments and applications of the present invention have been illustrated and described, it is to be understood that the invention is not limited to the precise configuration and components disclosed herein. Various modifications, changes, and variations which will be apparent to those skilled in the art may be made in the arrangement, operation, and details of the methods and systems of the present invention disclosed herein without departing from the spirit and scope of the invention.

WHAT IS CLAIMED IS:

1. An apparatus for distributing video and/or audio and/or data (v/a/d) to multiple presentation units, the apparatus comprising:

a signal input capable of receiving a plurality of v/a/d signals;

a plurality of selectors coupled to the signal input, the selectors being capable of selecting v/a/d signals from the received v/a/d signals;

a plurality of modulators coupled to the plurality of selectors, the modulators being capable of modulating carrier signals with the selected v/a/d signals;

a multiplexer coupled to the modulators, the multiplexer being capable of outputting a distribution signal which carries the modulated carrier signals; and

a control input including a wireless receiver capable of receiving control signals specifying which received v/a/d signals are to be selected by the selectors.

2. The apparatus of claim 1, wherein the apparatus includes at least two modulators.

3. The apparatus of claim 1, wherein the apparatus includes no more than thirty modulators.

4. The apparatus of claim 1, wherein the apparatus includes a semiconductor device that contains a subset of the modulators, the semiconductor device outputting a subset of the modulated carrier signals as a block of signals occupying a first frequency band.

5 The apparatus of claim 4, further comprising an upconverter that frequency shifts the block of signals from the first frequency band to a second frequency band.

6. The apparatus of claim 1, wherein at least one of the selected v/a/d/ signals is separated into a plurality of component signals, and wherein carrier signals are modulated with the component signals to produce at least two of the modulated carrier signals.

7. The apparatus of claim 6, wherein the at least one of the selected v/a/d signals is a video signal and the component signals include a luminance (Y) component signal and a chrominance (C) component signal.

8. The apparatus of claim 6, wherein the at least one of the selected v/a/d signals is an audio signal and the component signals include a first audio signal occupying a first frequency band and a second audio signal occupying a second frequency band.

9. The apparatus of claim 1, wherein the distribution signal carries at least a baseband signal representing at least one of the selected v/a/d signals or a portion of one of the selected v/a/d signals.

10. The apparatus of claim 9, wherein at least one of the selected v/a/d/ signals is separated into a plurality of component signals, and wherein one of the component signals is represented by the baseband signal.

11. The apparatus of claim 10, wherein the at least one of the selected v/a/d signals is a video signal and the component signals include a luminance (Y) component signal and a chrominance (C) component signal.

12. The apparatus of claim 10, wherein the at least one of the selected v/a/d signals is an audio signal and the component signals include a first audio signal occupying a first frequency band and a second audio signal occupying a second frequency band.

13. The apparatus of claim 1, wherein the distribution signal includes at least a pass-through version of at least one of the selected v/a/d signals.

14. The apparatus of claim 13, wherein the pass-through version is a digital signal.

15. The apparatus of claim 13, wherein the pass-through version is an analog signal.

16. The apparatus of claim 13, wherein the pass-through version is produced by digital-to-analog conversion or analog-to-digital conversion of the at least one of the selected v/a/d signals.

17. The apparatus of claim 1, wherein the signal input is designed to receive at least video signals.

18. The apparatus of claim 17, wherein the video signals are communicated via a satellite distribution network to the apparatus.

19. The apparatus of claim 17, wherein the video signals are communicated via a cable distribution network to the apparatus.

20. The apparatus of claim 17, wherein the video signals include digital video signals, and further comprising:

a decoder capable of decoding selected digital video signals to generate analog video signals.

21. The apparatus of claim 20, wherein the multiple presentation units include multiple analog television receivers, and wherein the apparatus enables conversion of the selected digital video signals to analog video signals for distribution to the multiple analog television receivers without use of digital set top units.

22. The apparatus of claim 17, wherein the carrier signals comprise television channels.

23. The apparatus of claim 1, wherein the signal input is designed to receive at least one data signal.

24. The apparatus of claim 23, wherein the data signal includes packets from the Internet.

25. The apparatus of claim 23, wherein the modulators include a QAM modulator for modulating a carrier signal with the data signal.

26. The apparatus of claim 23, wherein the modulated carrier signal is compatible with a standard from a group of standards including DOCSIS, DAVIC, and IEEE standards.

27. The apparatus of claim 1, wherein the signal input is designed to receive at least one audio signal.

28. The apparatus of claim 1, further comprising:

an amplifier coupled to the multiplexer for amplifying the distribution signal.

29. The apparatus of claim 1, wherein the distribution signal is output by the apparatus to a cable distribution network of a home or business.

30. The apparatus of claim 29, wherein the cable distribution network comprises at least a coaxial cable having a metal conductor carrying DC power.

31. The apparatus of claim 1, wherein the wireless receiver utilizes a non-direct-line-of-sight wireless technology.

32. A method for distributing video and/or audio and/or data (v/a/d) to multiple presentation units, the method comprising:

receiving a plurality of N v/a/d signals;

receiving wireless control signals from one or more control units;

selecting a plurality of selected v/a/d signals from the N received v/a/d signals;

modulating a plurality of carrier signals with the selected v/a/d signals to create a plurality of modulated carrier signals;

multiplexing the modulated carrier signals to create a distribution signal; and

outputting the distribution signal to the multiple presentation units,

wherein said selecting depends on the wireless control signals.

33. The method of claim 32, wherein the N received v/a/d signals include digital video signals, and further comprising:

decoding a digital video signal to generate an analog video signal if the digital video signal is among the selected v/a/d signals.

34. The method of claim 32, wherein the multiple presentation units include multiple analog television receivers, and wherein the method enables the digital video signals to be converted to analog video signals for distribution to the multiple analog television receivers without use of digital set top unit.

35. The method of claim 32, wherein more than one selected v/a/d signals may comprise a same received v/a/d signal.

36. A mini headend apparatus that enables controlled distribution of video signals received in digital form to a plurality of analog television receivers in a building without requiring use of set top units.

37. A method for controlled distribution of video signals received in digital form to a plurality of analog television receivers in a building without requiring use of set top units.

38. A system for distributing v/a/d within a building, the system comprising:

a receiver coupled to a broadband source, which receiver is capable of receiving a plurality of N v/a/d channels;

at least two modulators coupled to said receiver, said modulators being capable of outputting any selected one of the N v/a/d channels onto respective different ones of a smaller plurality of n television tuner channels;

at least two television sets capable of being tuned to different ones of said n television tuner channels;

a cable infrastructure connecting said television sets to a cable port;

a signal combiner coupled to said modulators for communicating the outputs of said modulators to said cable port;

at least two wireless communication devices capable of specifying different ones of said n television tuner channels, each wireless communication device being further capable of specifying any desired one of said N v/a/d channels; and

a wireless receiver that receives signals from said wireless communication devices and controls said modulators to output specified v/a/d channels on specified television tuner channels.

39. A method for distributing v/a/d within a building, the method comprising:

receiving a plurality of N v/a/d channels from a broadband source;

receiving at least two wireless communications, each specifying (a) one of the plurality of N v/a/d channels, and (b) one of a smaller plurality of n television tuner channels;

in response to each wireless communication, modulating the specified v/a/d channel content onto a frequency band that characterizes the specified television tuner channel;

combining the content of the specified v/a/d channels, so modulated, onto a common cable feed; and

interfacing the common cable feed to a cable infrastructure within the building.

40. The method of claim 36, and further comprising:

tuning at least two television sets to different desired ones of the plurality of n television tuner channels; and

associating a plurality of wireless communication devices with at least two of the plurality of n television tuner channels.

41. The apparatus of claim 1, the apparatus further comprising:

a conditional access mechanism to control distribution of premium content.

42. The apparatus of claim 1, the apparatus further comprising:

a parental control mechanism for detecting and controlling distribution of content inappropriate for viewing by children.

43. The apparatus of claim 1, the apparatus further comprising:

a common electronic program guide which spans v/a/d signals originating from more than one type of source.

44. The apparatus of claim 1, the apparatus further comprising:
a mass storage unit for providing centralized digital recording at the apparatus.

45. The apparatus of claim 1, the apparatus further comprising:
a DVD system for providing a v/a/d signal that may be distributed via the apparatus.

46. The apparatus of claim 1, the apparatus further comprising:
picture-in-picture circuitry to provide picture-in-picture functionality at the multiple presentation units.

47. The apparatus of claim 1, the apparatus further comprising:
game controller circuitry for supporting a plurality of game controllers playing games at a plurality of presentation units.

48. The apparatus of claim 1, the apparatus further comprising:
targeted advertisement insertion circuitry for inserting targeted advertisements into the v/a/d signals.

49. A computer-readable medium containing computer-readable program code for distributing video and/or audio and/or data (v/a/d) to multiple presentation units, the computer-readable program code comprising:
instructions for receiving a plurality of N v/a/d signals;
instructions for receiving wireless control signals from one or more control units;
instructions for selecting a plurality of selected v/a/d signals from the N received v/a/d signals;
instructions for modulating a plurality of carrier signals with the selected v/a/d signals to create a plurality of modulated carrier signals;
instructions for multiplexing the modulated carrier signals to create a distribution signal; and
instructions for outputting the distribution signal to the multiple presentation units,
wherein said selecting depends on the wireless control signals.

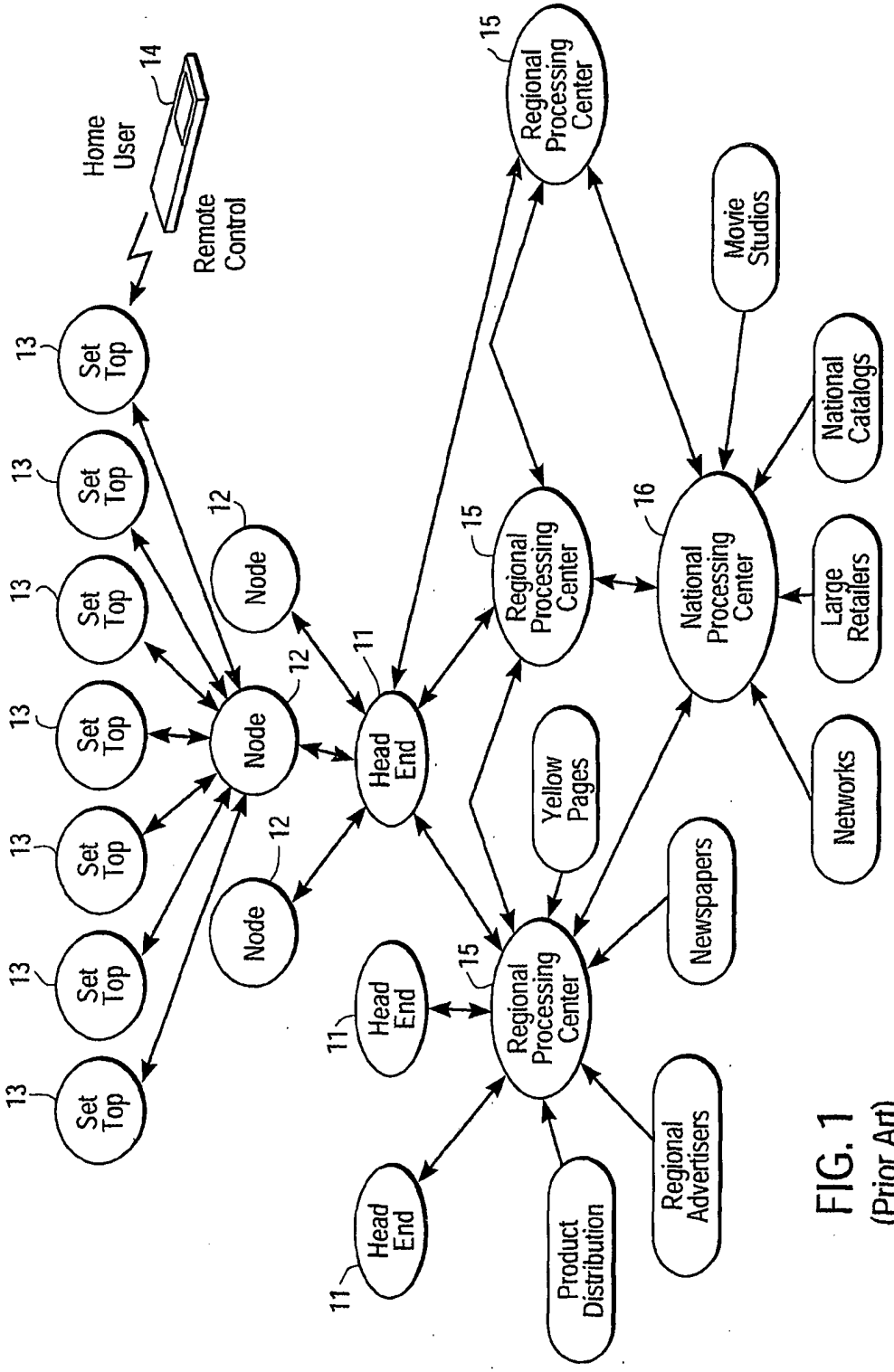


FIG. 1
(Prior Art)

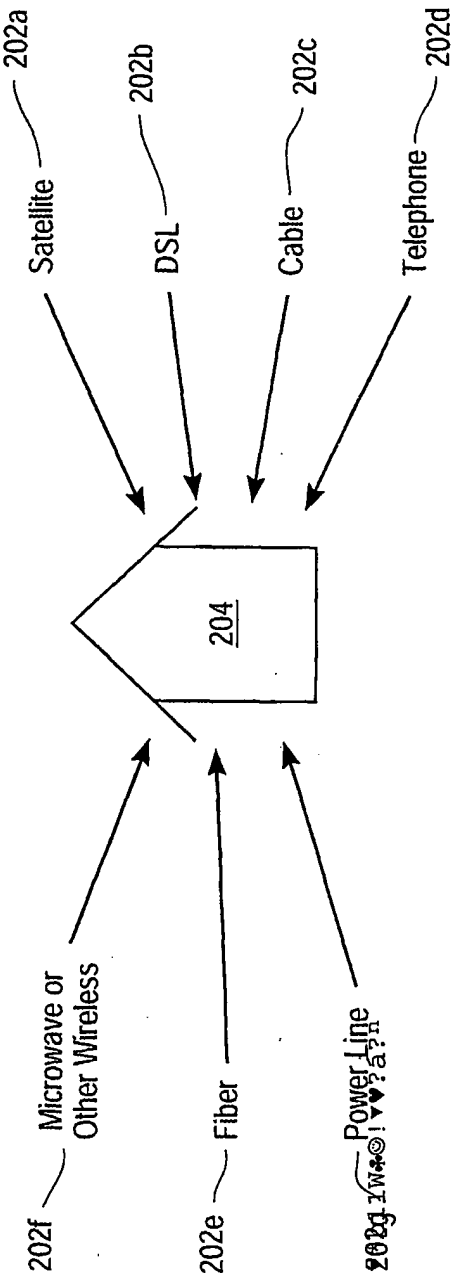

202a
Satellite
202b
DSL
202c
Cable
202d
Telephone
204
202f
Microwave or
Other Wireless
202e
Fiber
Power Line

FIG. 2

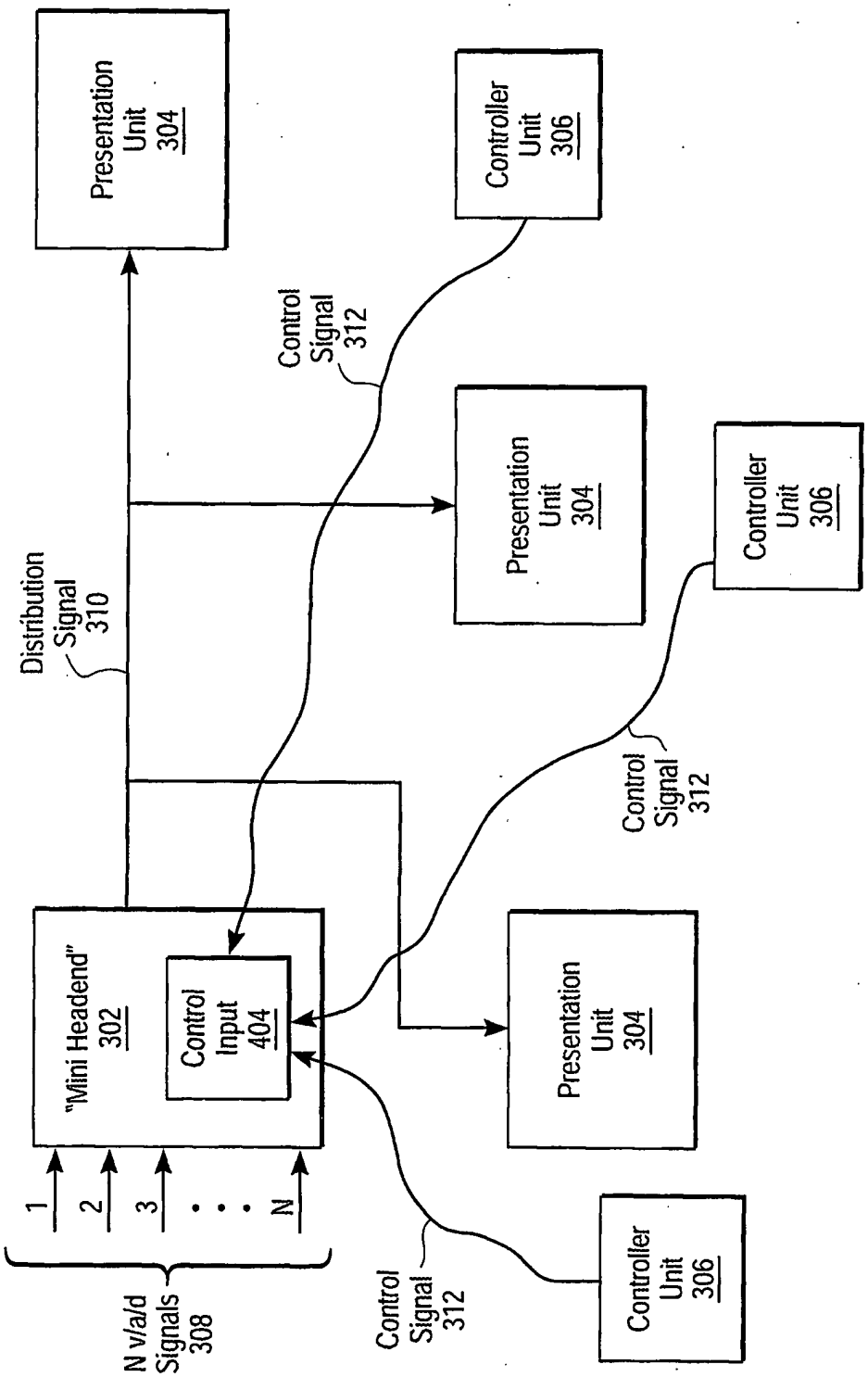

Presentation Unit 304
Controller Unit 306
Control Signal 312
Presentation Unit 304
Controller Unit 306
Distribution Signal 310
Control Signal 312
"Mini Headend" 302
Control Input 404
Presentation Unit 304
1
2
3
• • •
N
N v/a/d Signals 308
Control Signal 312
Controller Unit 306

FIG. 3

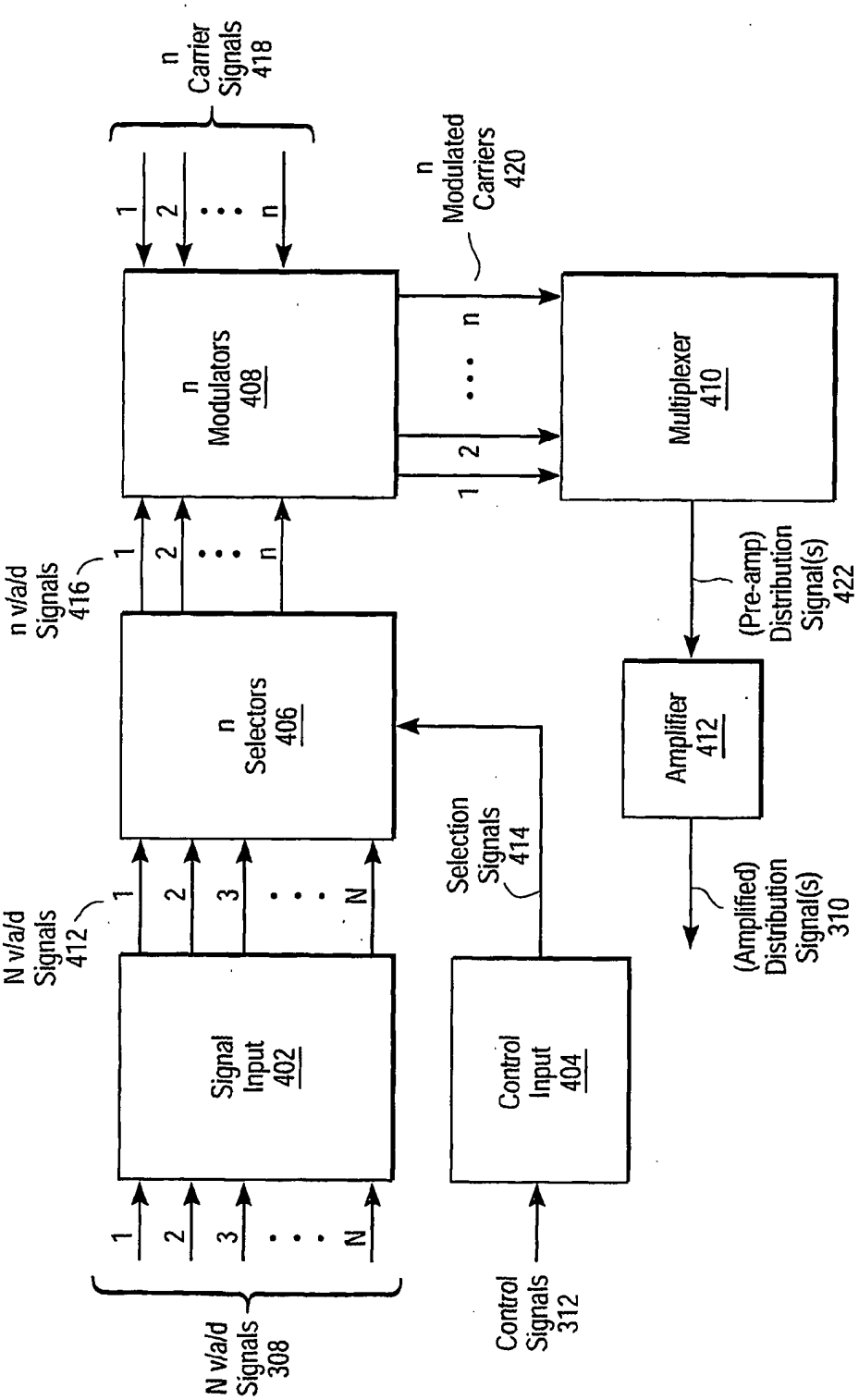

n Carrier Signals 418
n Modulated Carriers 420
n Modulators 408
Multiplexer 410
n v/a/d Signals 416
n Selectors 406
(Pre-amp) Distribution Signal(s) 422
Amplifier 412
302
Selection Signals 414
N v/a/d Signals 412
Signal Input 402
Control Input 404
(Amplified) Distribution Signal(s) 310
N v/a/d Signals 308
Control Signals 312

FIG. 4

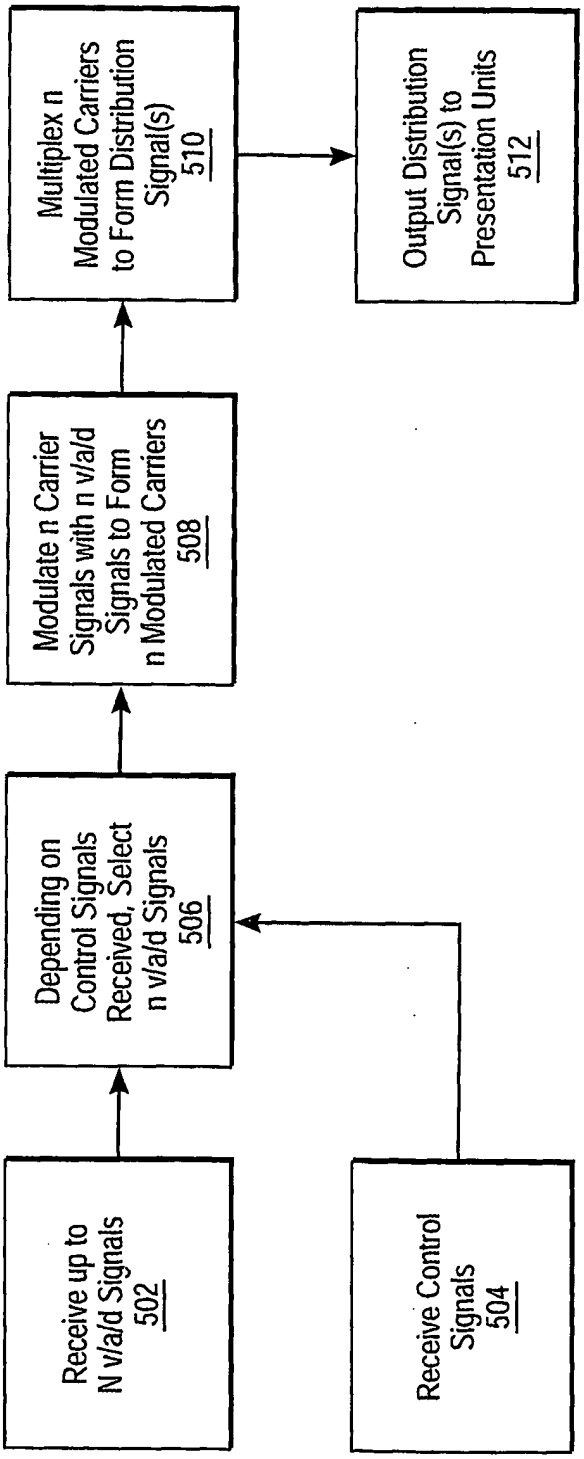

Receive up to N v/a/d Signals 502
Receive Control Signals 504
Depending on Control Signals Received, Select n v/a/d Signals 506
Modulate n Carrier Signals with n v/a/d Signals to Form n Modulated Carriers 508
Multiplex n Modulated Carriers to Form Distribution Signal(s) 510
Output Distribution Signal(s) to Presentation Units 512
500

FIG. 5

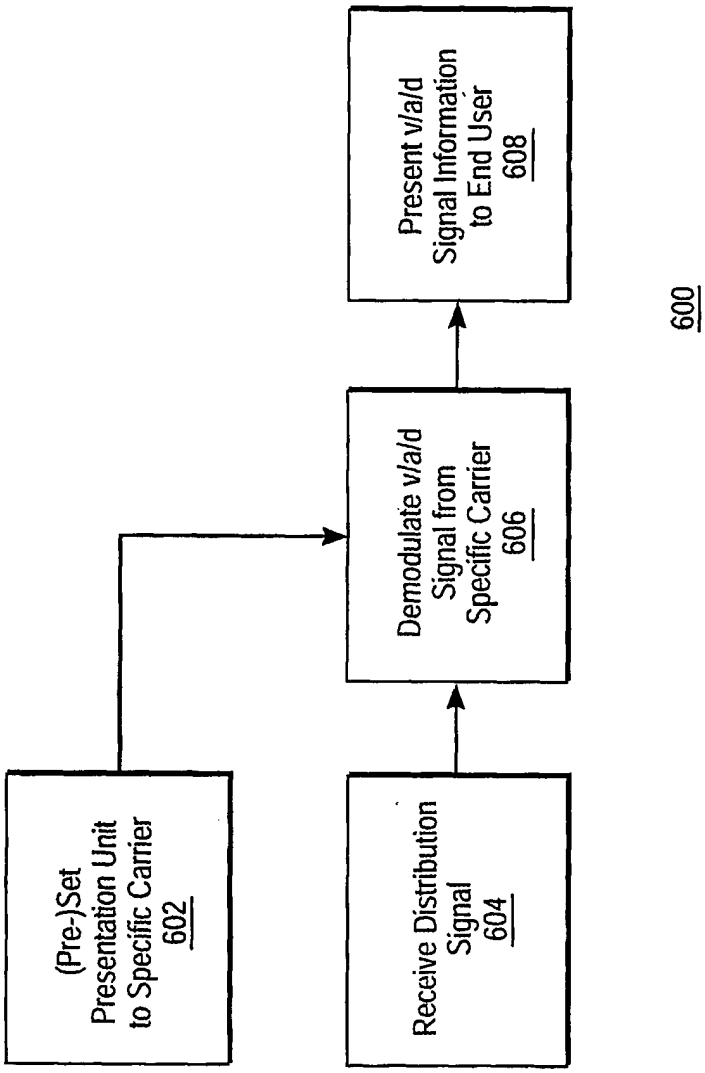
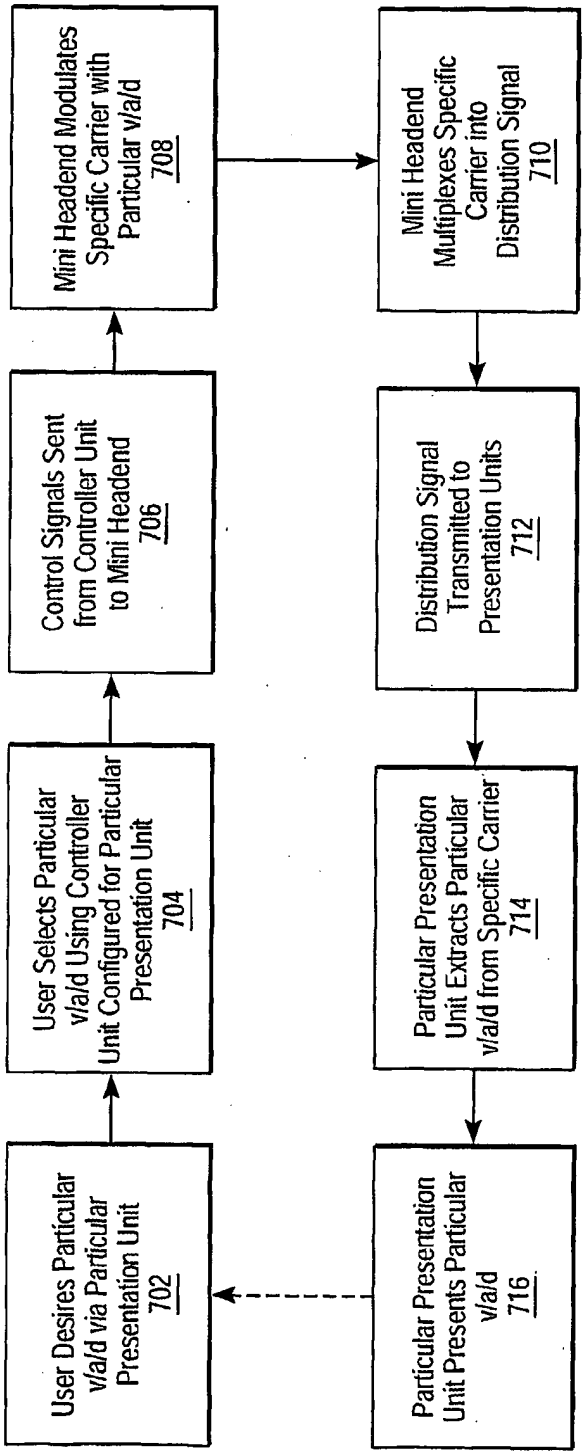

(Pre-)Set Presentation Unit to Specific Carrier 602
Receive Distribution Signal 604
Demodulate v/a/d Signal from Specific Carrier 606
Present v/a/d Signal Information to End User 608
600

FIG. 6


User Desires Particular v/a/d via Particular Presentation Unit 702
User Selects Particular v/a/d Using Controller Unit Configured for Particular Presentation Unit 704
Control Signals Sent from Controller Unit to Mini Headend 706
Mini Headend Modulates Specific Carrier with Particular v/a/d 708
Mini Headend Multiplexes Specific Carrier into Distribution Signal 710
Distribution Signal Transmitted to Presentation Units 712
Particular Presentation Unit Extracts Particular v/a/d from Specific Carrier 714
Particular Presentation Unit Presents Particular v/a/d 716

700

FIG. 7

INTERNATIONAL SEARCH REPORT

Ir ional application No.
PCT/US01/24858

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) :H04N 7/18

US CL :725/74, 78, 79, 80, 81, 82, 83, 84, 85

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 725/74, 78, 79, 80, 81, 82, 83, 84, 85

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

NONE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EAST - home, distribution, sources, modulators

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,389,963 A (LEPLEY et al) 14 February 1995, whole document	1-49
A	US 5,249,043 A (GRANDMOUGIN) 28 September 1993, whole document	1-49
A	US 5,193,208 A (YOKOTA et al) 09 March 1993, ALL	1-49
A	US 4,920,432 A (EGGERS et al) 24 April 1990, whole document	1-49

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search	Date of mailing of the international search report
16 OCTOBER 2001	16 NOV 2001
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer VIVEK SRIVASTAVA Telephone No. (703) 305-4038

Form PCT/ISA/210 (second sheet) (July 1998)★